REPORT ON THE EVALUATION OF BAYLUSCIDE AS A CONTROL METHOD FOR SWIMMER'S ITCH

INTRODUCTION

There has been increasing concern in recent years over the number of cases of swimmer's itch reported from the lake areas of Ontario. This complaint, more accurately known as schistosome dermatitis, is a temporary skin infection acquired by bathers in some lakes when they come into contact with the larvae of a small aquatic flatworm. These larvae, termed cercariae, are released into the water from certain species of snails which serve as secondary hosts for other stages in the life-cycle of the flatworm. The cercariae normally infect aquatic birds and mammals in which the adult flatworms develop, but occasionally, particularly in June and July when cercariae are most abundant, people swimming in the water may also be infected. However, in the case of man once penetration of the skin has been accomplished the cercariae die rapidly and further infection does not occur.

Control measures in the past have involved the eradication of the snail hosts of the cercariae through the use of copper sulphate. However, the limited amount of success gained with this chemical prompted investigation into other, more satisfactory control methods. One such method is at present undergoing a series of evaluation by the OWRC. This is a granular formulation of a chemical known as Bayluscide which has already been used experimentally in the state of Michigan. Results of these experiments indicated that 7 ppm (theoretical) of 5% Bayluscide in the bottom three inches of water is an effective molluscicide and is relatively safe to use in the aquatic environment.

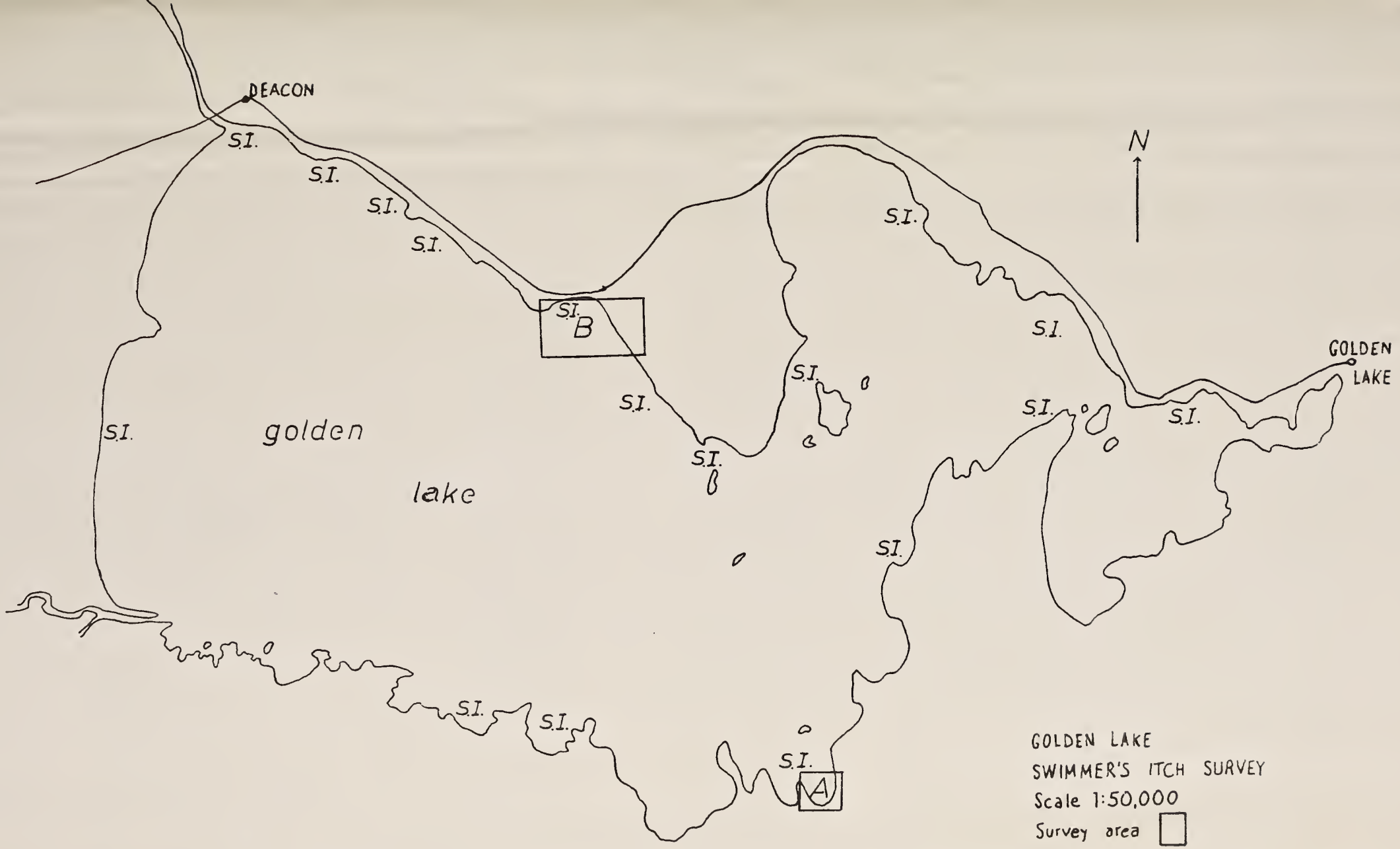


FIGURE 1. S.I. — swimmer's itch reported.

At this concentration the expected snail mortality was established to be 80% (Newton and Fetterolf, 1967).

Previous work by the OWRC using both the granular and wettable powder formulations of Bayluscide had shown that the latter applied at 0.67 ppm active (based on total water volume) was an effective molluscicide, but was highly toxic to a wide variety of fish species, crayfish and clams. The results obtained following application of a heavier granular formulation proved more hopeful from the standpoint of fish toxicity but some doubt remained as to the precise concentration that should be employed and to the effects of treating large areas at a time. Thus, it was decided to continue this work in 1968 with a view to more precise evaluation of the Bayluscide granular formulation.

There are a number of localities in Ontario where swimmer's itch is a problem, but once again it was decided to conduct the test programme at Golden Lake where swimmer's itch has been an unpleasant hazard to bathers over the past six years.

Procedure

A preliminary survey of cottage and resort owners along the perimeter of Golden Lake was undertaken to ascertain the incidence of swimmer's itch throughout the lake. To verify the presence of cercariae in those areas designated as major trouble areas, live snails were collected and later examined. Figure I indicates the localities around the lake shore where swimmer's itch has been problematical.

It was learned while conducting the preliminary survey that many of the cottage owners and some of the resort owners were presently utilizing copper sulphate in an attempt to control swimmer's itch. On this account, caution had to be exercised to insure that the selected test sites for Bayluscide were not those to which copper sulphate had already been applied. Samples of snails were taken from two

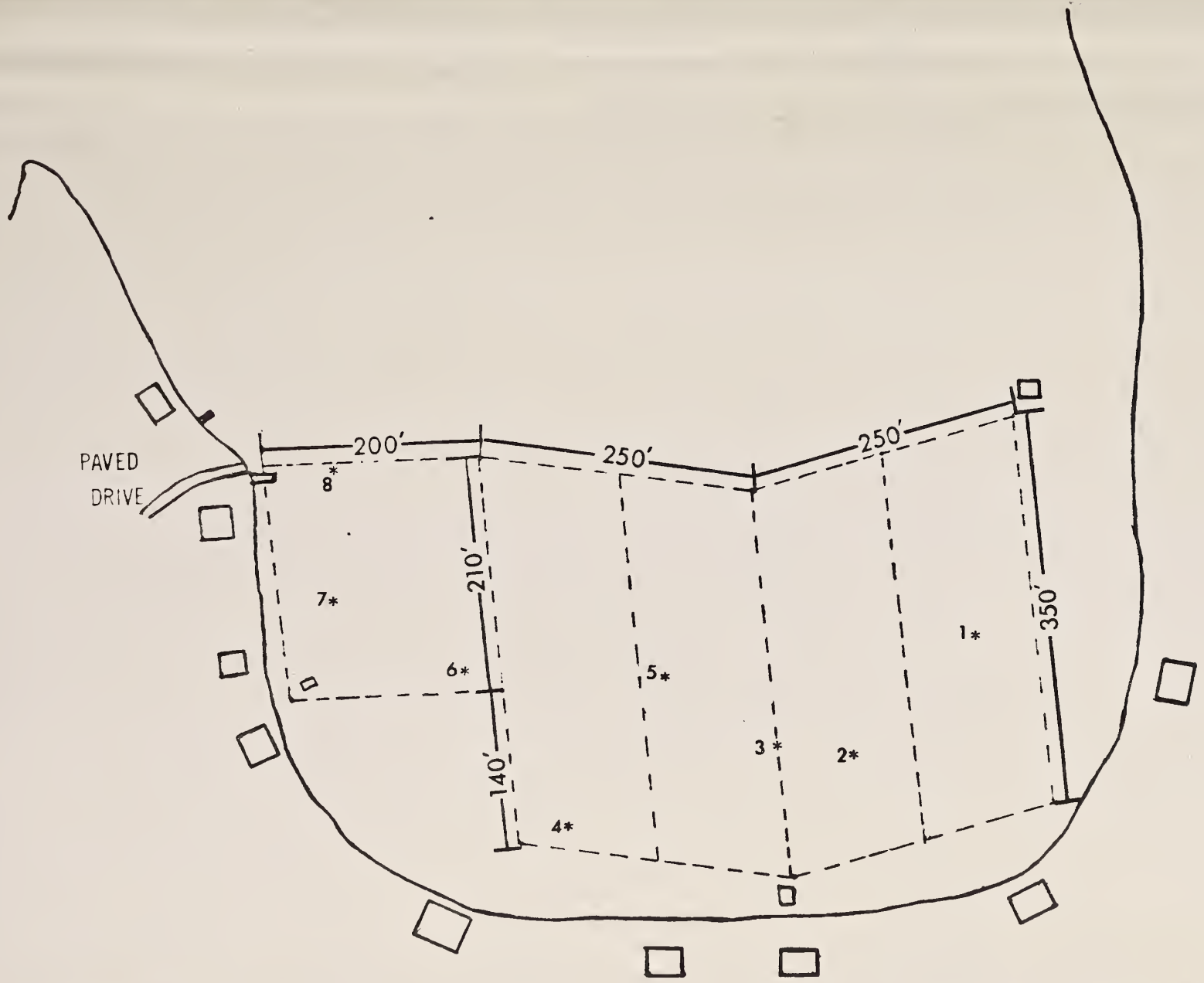
chosen areas to confirm the presence of cercariae. One was situated on the northern and the other on the southern shore of the lake. The first was a five-acre site, hereafter known as Bowe's Test area, positioned mid-way along a westerly exposed beach. The second, also of five acres, was located in a sheltered bay and will be known as Bay 'A'. Figure I shows the location of the test sites.

Random sampling of snails on both sites, using weighted squares of ½ square metre, was conducted just before treatment. The number of snails of each genera found within the squares was recorded. Three types of cage were anchored within the boundaries of the test sites and a similar number were placed outside these areas to act as controls. Animals were introduced into these cages as follows:

SNAILS	CLAMS & CRAYFISH	FISH
Campeloma sp.	Elliptio complanata	Ambloplites rupestris
Helisoma spp.	Orconectes spp.	Boleosoma nigrum
Physa sp.		Lepomis gibbosus
Stagnicola sp.		Micropterus dolomieu
		Notropis hudsonius
		Perca flavescens
		Stizostedion vitreum

Snails and clams were contained in all cages, while fish and crayfish were restricted to the larger wire screen cages. Figures II and III show the position of cages in the two test areas.

The chemical was applied using a battery-operated cyclone seeder which was mounted on a platform at the front of a 13' 3" Boston Whaler. Owing to the nature of the chemical used and the weather conditions existing at the time of application, it was necessary to operate the motorized boat in reverse while the chemical was being applied. Bayluscide treatment of the Bowe's Test area took place on the evening of July 5th and Bay 'A' was treated on the evening of July 7th, 1968. Both areas received 100 pounds



GOLDEN LAKE
SWIMMER'S ITCH SURVEY
BAY A
Scale: 1 inch equals 150 ft.
Station *

FIGURE 2.

of Bayluscide 5% granular per acre, a rate providing a concentration of 7 ppm in the bottom three inches of water.

Results

Data for each stage of the evaluation experiments has been tabulated as follows:

Table 1

a. Mortality rates of caged snails

b. Mortality of uncaged snails

c. Comparison of data from a and b.

Table 2

Data showing the mortality of Lepomis, Elliptio and Orconectes over a 96-hour post-treatment period.

Two factors combined to render many of the results of these experiments somewhat inconclusive.

1. It was rapidly discovered that most fish species could not be kept under caged conditions. Four or five hundred fish had been netted and caged for these experiments but of these all but a few dozen died within twenty-four hours of caging. An exception to this appeared in the case of Lepomis as approximately 60% of these fish survived 96-hours in the control cages. For this reason, results of pre- and post-treatment counts of fish are given for Lepomis only. Various methods of keeping caged fish alive were tested, but all failed. The controlling factor appeared to be lack of oxygen since all dead fish had their mouths open and were noted at the surface gulping air just prior to death.

2. Fifteen minutes after completion of chemical application at the Bowe's Test area, a sudden storm developed. The storm lasted only ten minutes, but the high velocity winds caused considerable wave action which may have affected the concentration achieved in the test area. Relatively calm conditions prevailed at Bay 'A' during the chemical treatment and for the 96-hour observation period following.

Table 1. Experimental treatment of two five-acre plots with Bayluscide 5% granular at 100 lbs.per acre.

A. Mortality rates of caged snails

	Exposure time,hrs.	Stagnicola	Campeloma	Helisoma
Bowe's Test Area - Treated July 5,1968	0	52 alive	8 alive	60 alive
	24			4 dead
	60	15 dead	2 dead	14 dead
	72	8 dead	1 dead	9 dead
	96	13 dead	3 dead	22 dead
No.remaining alive		16	2	11
% killed after 96 hrs.		69%	75%	82%

Total Mortality - 76%

Bay 'A' Treated July 7,1968	0	47 alive	3 alive	55 alive
	24	35 dead	2 dead	53 dead
	48	6 dead		2 dead
	72	5 dead		
	96			
No. remaining alive		1	1	
% killed after 96 hrs.		98%	67%	100%

Total Mortality - 98%

Control - No mortality after 96 hours.

B. Mortality of uncaged snails - data based on random sampling of approximately 100 sq. metres.

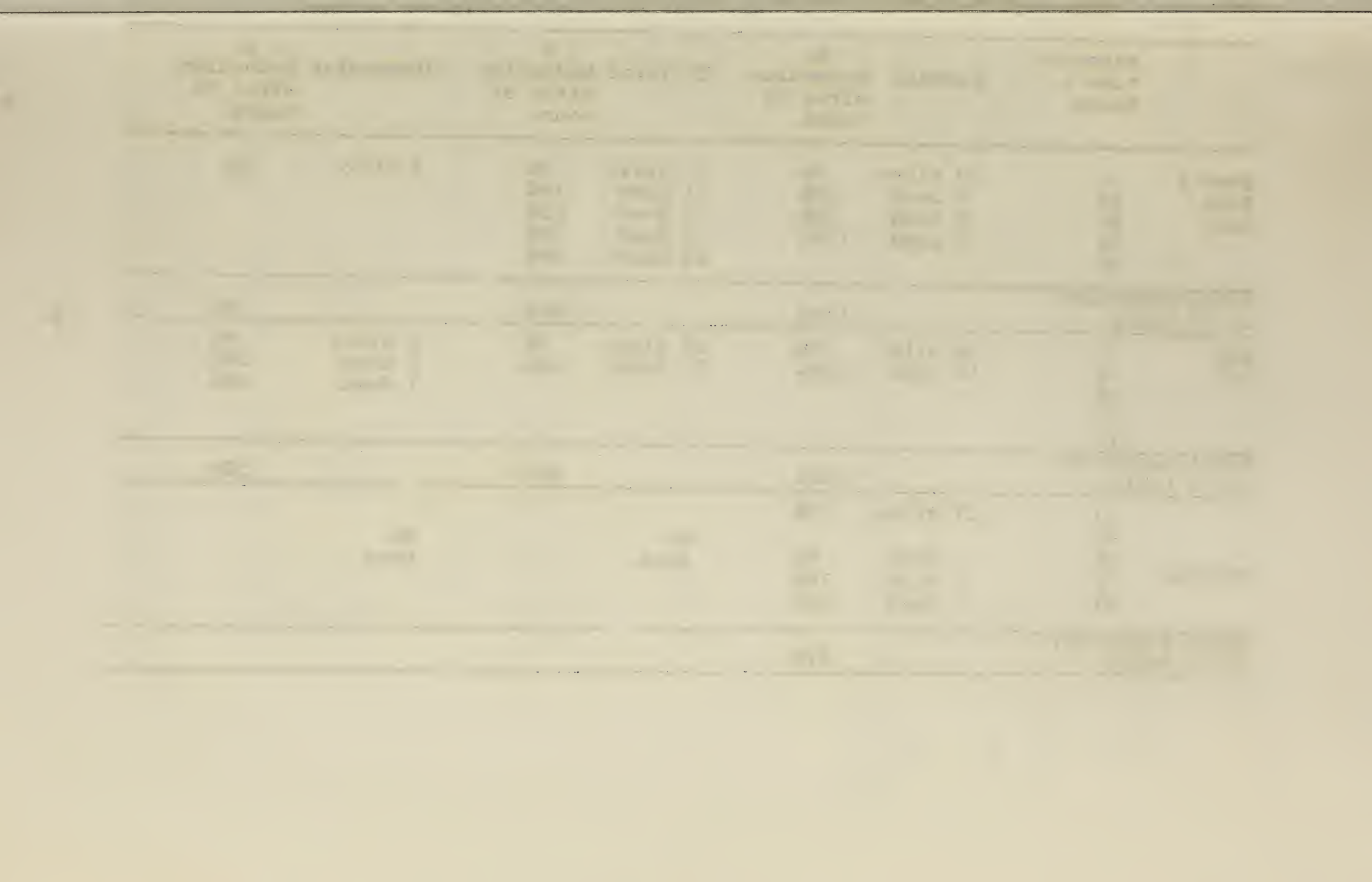
	Genera	Pre-treatment No.found alive	Post-treatment No.found alive	% Reduction	Overall % Reduction
Bowe's Test Area	Campeloma	4	1	75%	
	Helisoma	47	13	72%	69%
	Stangicola	23	9	61%	
Bay 'A'	Campeloma	2	1	50%	
	Helisoma	166	7	96%	95%
	Stagnicola	18	1	94%	

C. Comparison of data from A and B. Percentage reductions - post-treatment.

		Campeloma	Helisoma	Stagnicola	Overall % Reduction
Bowe's Test Area	Caged	75%	82%	69%	76%
	Uncaged	75%	72%	61%	69%
Bay 'A'	Caged	67%	100%	98%	98%
	Uncaged	50%	96%	94%	95%

Table 2. Data showing the mortality of pumpkinseed sunfish (Lepomis), clams (Elliptio) and crayfish (Orconectes) over a 96-hour post-treatment period.

	Exposure time - hours	Lepomis	% Reduction after 96 hours	Elliptio	% Reduction after 96 hours	Orconectes	% Reduction after 96 hours
Bowe's Test Area	0	20 alive	0%	60 alive	0%	4 alive	0%
	24	6 dead	30%	11 dead	18%		
	60	9 dead	75%	3 dead	23%		
	72	5 dead	100%	2 dead	27%		
	96			13 dead	48%		
Total Reduction in 96 hours.			100%		48%		0%
Bay 'A'	0	16 alive	0%	57 alive	0%	4 alive	0%
	24	16 dead	100%	37 dead	66%	1 dead	25%
	48					1 dead	50%
	72						
	96						
Total Reduction in 96 hours			100%		66%		50%
Control	0	27 alive	0%	No Data		No Data	
	24						
	48	1 dead	4%				
	72	9 dead	37%				
	96	1 dead	41%				
Total Reduction in 96 hours			41%				



Examination of the data in Table 1 reveals that Bayluscide is highly toxic to snails. Of the three species used in the experiments, Helisoma appeared to be slightly more susceptible that the other two. The greater success in Bay 'A' as compared to that in Bowe's Test area was probably attributable to the sudden storm referred to earlier. A rapid decrease in the concentration of the chemical and a shortening of exposure time may have considerably lessened the effect of treatment. In both situations, the caged snails suffered heavier losses, signifying that estimation of mortality amongst free-living snails is a more reliable measure of toxicity.

Many of the snails placed in bi-level cages climbed to the top of the cages. Fewer snails in the upper compartments (1 ft. off the bottom) died that those in the lower compartments but the respective numbers involved were too small to be statistically significant. Owing to wave action some of the smaller cages were partially filled with sand and it was necessary to wash the cages out each day when they were examined.

Once dead, the bodies of Helisoma spp. and Stagnicola spp. were easily shaken from their shells, but it was necessary to pull the body of Campelona spp. out of it's shell before a decision could be made as to its condition. Only after Campelona sp. had been dead five or six days did they fall out of the shell when shaken.

Table 2 shows that Lepomis was severely affected by Bayluscide. Although 60% of the control specimens remained alive during the 96-hour observation period none survived more than 72 hours in either of the two treatment areas. In Bay 'A', where treatment was probably more thorough, all the Lepomis specimens succumbed within 24 hours.

During post-treatment surveying of Bay 'A' numerous dead juvenile fish were found on the lake bottom. Examination

of the bay and its shoreline failed to turn up any dead adult fish. Neither free-swimming juveniles nor adult fish were found dead in the Bowe's Test area.

Table 2 also shows that significant numbers of caged crayfish and clams died in Bay 'A'. The turbulence in Bowe's Test area probably explains the survival of the crayfish at this site but even here the number of clams was considerably reduced. It is unlikely that caging would affect either of these two groups.

Discussion

These experiments demonstrate the effect that adverse weather conditions may have on chemical treatment of aquatic habitats. In an exposed area such as Bowe's Test area, where the surface water was kept in motion by wave action, the results were poorer than in a sheltered region such as Bay 'A'. Also, certain difficulties encountered while disseminating the molluscicide in the Bowe's Test area were later overcome, and it is likely that this fact also contributed to the superior results achieved in Bay 'A'.

The susceptibility of fish to Bayluscide could not be determined with any accuracy, but the severe mortality amongst caged Lepomis specimens is worthy of note. The large number of juvenile fish killed in Bay 'A' may be due to the fact that they were trapped in the test area. The chemical was applied from the outer edge of the plot toward the shore thereby cutting off their escape route from the bay. Bowe's Test area, in which no fish mortality was noted, was treated by applying the chemical from the shore outward.

On August 17th, 1968, cottage and resort owners at Golden Lake were questioned regarding swimmer's itch and all agreed that there had been no further cases of the complaint in either of the treated areas. All reports

of swimmer's itch at Golden Lake, up to the time of writing, have come from areas outside the two test sites. This confirms the conclusion that Bayluscide treatment of the two lake areas for the control of swimmer's itch was entirely successful. However, it must be added that the question of the chemical's effect on non-target organisms has not been fully resolved.

Recommendations

1. Surveys should be conducted in the test area early next spring to determine:

(a) Numbers and species of snail present
(b) Location of snails in relation to treated area
(c) Incidence of cercariae in snail population

2. To better determine the effect of Bayluscide on fish, further testing should be undertaken. Instead of using small cages, the fish should be contained in large fenced enclosures at least 100 square feet in size. The fish would thus have greater freedom of movement and conditions would more closely resemble those encountered by free swimming fish.

3. Further studies of the habits of snails should be undertaken. Previous work indicates that snail populations exhibit a pattern of migration from deeper to shallow water in spring, and that they will quickly recolonize an area where the snail population has been eradicated. Furthermore, it has been shown that snail numbers fall sharply in October and November and only a few adults of each species survive the winter. As breeding commences rapidly in March and numbers build up enormously in succeeding months, any control by chemical application should take place as early in the spring as possible. Finally, as the snails often inhabit specific areas of the lake bed, considerable effort should be made prior to chemical treatment to ascertain exactly where the highest concentrations of host snails are to be found.

4. Scuba equipment should be used wherever possible when conducting surveys. This would greatly reduce the time needed to sample an area or to collect snails from deep water.

5. Use of a mechanical spreader should be continued when applying the granular chemical.

6. The chemical should be applied only during calm weather, thereby allowing time for it to settle to the bottom.

7. Further use of Bayluscide 5% granular should be at the rate of 100 lbs. per acre. It is of great importance to insure that application techniques are efficient and thorough.

8. When applying the chemical it should be applied from the shore outward rather than toward the shore.

Conclusion

Based on the findings of this test, Bayluscide 5% granular appears very efficient in killing snails. It would thus seem to be a desirable chemical for use in controlling swimmer's itch.

The method and rate of application employed during this evaluation are sufficient to achieve a high rate of success when used under good weather conditions.

The danger to fish populations following careful application of the chemical is considered minimal owing to dilution effect and the ability of fish to move quickly away from the treatment areas. Providing this method of control is only applied to relatively small sections of a body of water at any one time, slight mortality amongst some invertebrate groups is unlikely to disrupt the ecological balance of the entire area. However, considerable work

is still required to clarify the question of effect on non-target organisms and to supply more information about the behaviour of snail populations.

Acknowledgements

Thanks are extended to Chemagro Corporation who supplied the 1,000 pounds of Bayluscide 5% granular used during this test.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